PENTAIR

9U MTCA.4 Shelf

User‘s Manual

Product Number:

11850-026

Schroff®

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1 Safety

The intended audience of this User's Manual is system integrators and hardware/software engineers.

1.1 Safety Symbols used in this document

	Hazardous voltage! *This is the electrical hazard symbol. It indicates that there are dangerous voltages inside the Shelf.*

	Caution! *This is the user caution symbol. It indicates a condition where damage of the equipment or injury of the service personnel could occur. To reduce the risk of damage or injury, follow all steps or procedures as instructed.*

	Danger of electrostatic discharge! *The Shelf contains static sensitive devices. To prevent static damage you must wear an ESD wrist strap.*

1.2 General Safety Precautions

	Warning! *Voltages over 60 VDC can be present in this equipment. This equipment is intended to be accessed, to be installed and maintained by qualified and trained service personnel only.*

- Service personnel must know the necessary electrical safety, wiring and connection practices for installing this equipment.
- Install this equipment only in compliance with local and national electrical codes.

1.3 References and Architecture Specifications

- PICMG® MTCA.4 Specification
- PICMG® AMC® Base Specification
- PICMG® MicroTCA® Base Specification
  (*www.picmg.org*)

1.4 Product Definition

The Schroff **11850-026** is a 9 U MicroTCA.4 Shelf with rear µRTM area for AMC double mid-size modules and RTMs.

2 Hardware Platform

- Shielded galvanisized steel subrack with 19” rack mounting brackets
- MicroTCA Backplane with radial IPMI-L from both MCH slots to all AMC slots and bused IPMB-0 among MCHs, PMs and CUs.
- The Shelf provides:
  - 12 AMC double mid-size slots
  - 2 redundant MicroTCA Carrier Hub (MCH) slots (double full-size)
  - 4 Power Module (PM) slots (double full-size)
  - 12 RTM double mid-size slots
- Active cooling through two hot-swappable Cooling Units (CUs) in push-pull configuration, providing each:
  - 6 speed controlled 12 VDC fans.
  - Cooling Unit Enhanced Module Management Controller (CU EMMC)
  - Display Module
- Front accessible air filter

2.1 Front an Rear View

Figure 1: Shelf Front View

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1	Upper Cooling Unit (CU1)	5	Cable Tray
2	Lower Cooling Unit (CU2)	6	Backplane
3	Air filter	7	Card cage
4	ESD Wrist Strap Terminal		

Figure 2: Rear View

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8	Rear card cage	10	Ground Terminal
9	Cable Tray (Can be mounted above or below the card cage)		

2.2 ESD Wrist Strap Terminals

	Danger of electrostatic discharge! *Static electricity can harm delicate components. You must wear an ESD wrist strap before exchanging any part or electric component!*

The ESD Wrist Strap Terminal (4 mm banana jack) is located at the upper front side.

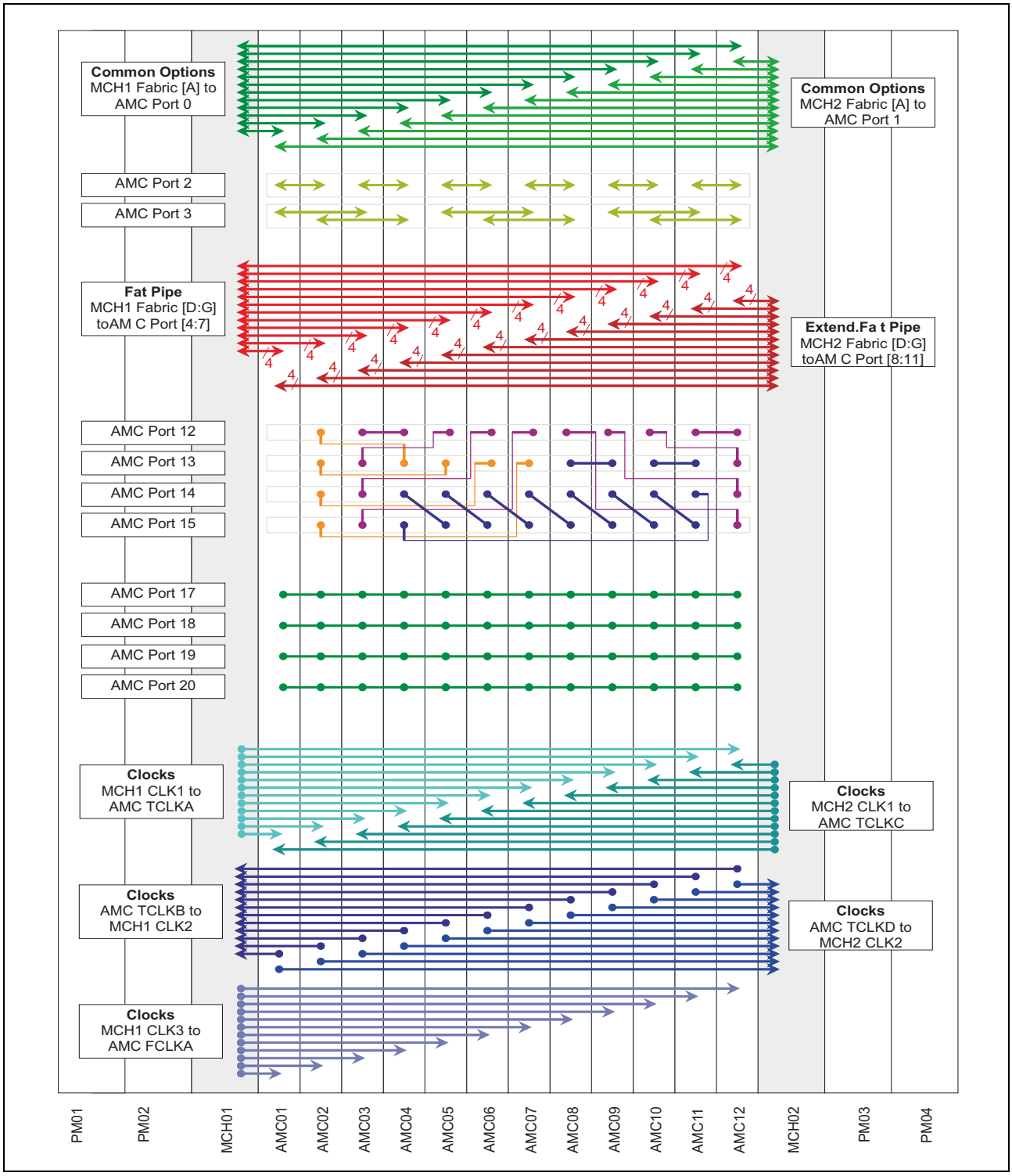
3 Backplane

The 12+2+4 slot MicroTCA Backplane provides:

- 12 AMC double Mid-size slots (4 HP)
- 2 double Full-size MicroTCA Hub (MCH) slots (6 HP)
- 4 Power Module (PM) slots for Double Full-size Power Modules or for 2 x 12 HP Power Modules
- 2 Connectors for Cooling Units

3.1 Backplane Topology

Figure 3: Backplane Topology



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3.2 Fabric Interface

3.2.1 Common Options

MCH1 Fabric Port A is routed to all AMC slots Port 0 in a radial configuration.

MCH2 Fabric Port A is routed to all AMC slots Port 1 in a radial configuration.

AMC Ports 2 and 3 are direct slot to slot connections to support CPU/HDD configurations.

3.2.2 Fat Pipe

MCH1 Ports [D:G] are routed to all AMC slots Port [4:7] in a radial configuration.

3.2.3 Extended Fat Pipe

MCH2 Ports [D:G] are routed to all AMC slots Port [8:11] in a radial configuration.

3.2.4 Ports 12 to 15

Ports 12 to 15 are point to point connections as proposed in the MTCA.4 specification section 6.7.1.

3.2.5 Ports 17 to 20

Ports 17 to 20 are used as a bus for triggers, clocks and interlock signal distribution.

3.3 Synchronization Clock Interface

Synchronisation clock topology in accordance with AMC.0 R2.0, especially for the use of PCIe AMC modules in accordance with AMC0 R2.0 that expect the FabricCLK on FCLKA.

Fully redundant telecom clock architecture with TCLKA, TCLKB, TCLKC,TCLKD.

3.4 Intelligent Platform Management Bus (IPMB)

MicroTCA uses an Intelligent Platform Management Bus (IPMB) for management communications.

3.4.1 IPMB-L

The IPMB among AdvancedMCs and the MCHs is non-redundant and implemented in a radial topology. This IPMB called Local IPMB (IPMP-L)

3.4.2 IPMB-0

The IPMB among the MCH, the PM and the CU is called IPMB-0. The reliability of the IPMB-0 is improved by the addition of a second IPMB, with the two IPMBs referenced as IPMB-A and IPMB-B.

The IPMB-A and IPMB-B are routed in a bused configuration.

IPMB-A and IPMB-B are electrically and logically separate from the Local IPMB (IPMB-L)

3.5 IPMB Addresses

GA[2:0]	IPMB-L address	MicroTCA Carrier Local Address		Carrier Manager FRU Device ID
		Site Number	Site Type	
GGU	72h	1	AdvancedMC (07h)	5
GUG	74h	2	AdvancedMC (07h)	6
GUU	76h	3	AdvancedMC (07h)	7
UGG	78h	4	AdvancedMC (07h)	8
UGU	7Ah	5	AdvancedMC (07h)	9
UUG	7Ch	6	AdvancedMC (07h)	10
UUP	7Eh	7	AdvancedMC (07h)	11
UPU	80h	08	AdvancedMC (07h)	12
UPP	82h	09	AdvancedMC (07h)	13
PUU	84h	10	AdvancedMC (07h)	14
PUP	86h	11	AdvancedMC (07h)	15
PPU	88h	12	AdvancedMC (07h)	16

GA[2:0]	IPMB-0 address	MicroTCA Carrier Local Address		Carrier Manager FRU Device ID
		Site Number	Site Type	
GGU	A8h	1	Cooling Unit (04h)	40
GUG	AAh	2	Cooling Unit (04h)	41
GGU	C2h	1	Power Module (0Bh)	50
GUG	C4h	2	Power Module (0Bh)	51
GUU	C6h	3	Power Module (0Bh)	52
UGG	C8h	4	Power Module (0Bh)	53

3.6 JTAG

JTAG signals are not supported.

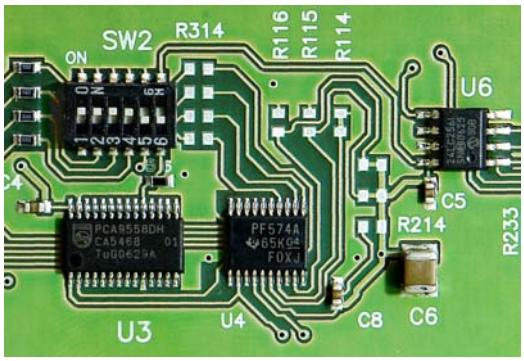
3.7 Carrier FRU SEEPROM

Two SEEPROMS are located at the backside of the Backplane. The SEEPROMS are connected to both MCHs through I²C-busses.

The I²C-addresses of the SEEPROMs is 0xa4.

3.8 Carrier Number

Figure 4: Electronic and mechanical DIP Switch



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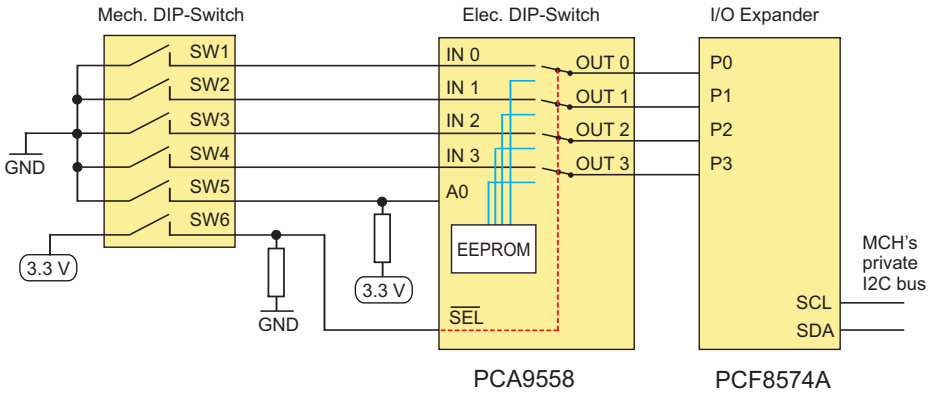
Each MicroTCA Carrier shall have a unique Carrier Number, ranging from 1 to 16 in its MicroTCA Shelf. To provide the Carrier Number, a mechanical and electronic (PCA9558) DIP switch and a PCF8574A I²C I/O expander is located on the Backplane.

Figure 5: Carrier Number Switches



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The customer can use either the mechanical or the electronic DIP switch to set the carrier number.

3.8.1 Mechanical DIP Switch

The mechanical DIP switch is a 6-position switch.

- Switch 1 to 4 are used to set the carrier number (Switch 1 = Bit 0).
- Switch 5 is used to change the I2C-address of the electronic DIP switch.
  - Switch 5 ON: address = 9C
  - Switch 5 OFF: address = 9E
- With switch 6 you can select between mechanical or electronic DIP switch to set the carrier number.
  - Switch 6 ON: Mechanical DIP switch active
  - Switch 6 OFF: Electronic DIP switch active

Two DIP Switches (for redundancy) are located on the Backplane. They are user-accessible after removing the cooling units.

*When setting the carrier number with the **mechanical** DIP switch please note:*

Switch ON = logic 0
Switch OFF = logic 1

The mechanical DIP switch is connected to the input of the electronic DIP switch.
When the SEL signal is a logic 0, the electronic DIP switch will select the data from the internal EEPROM to drive the output pins, when the SEL signal is a logic 1, the electronic DIP switch will select the signal from the mechanical DIP switch to drive on the output pins.

3.8.2 Electronic DIP Switch (factory default)

The electronic DIP switch is connected to the lower four bits of the I/O lines of the PCF8574A I²C I/O expander. The I/O expander connects to the MCMC's private I²C bus. The MCMC reads the DIP switch setting from the I/O expander, **adds one**, and uses the result as its Carrier Number.

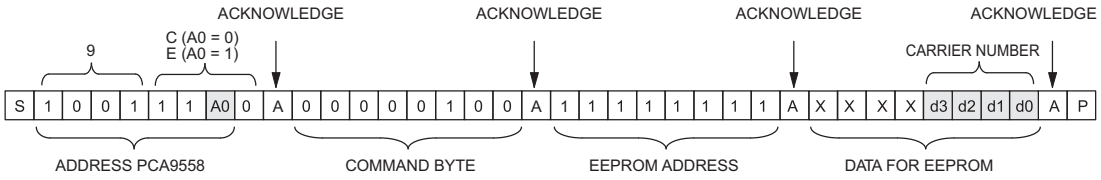
In the default factory setting the electronic DIP switch is active at the address 0x9E (SW5 and SW6 at the mechanical DIP switch = OFF)

Default carrier address = 1 (Data content EEPROM = 0000)

Table 1: I²C Addresses

PCA 9558 DIP switch	0x9e or 0x9c	0x9e or 0x9c = 8 bit address write (bit 0 = 0)
PCF8574A I/O expander	0x7c	0x3e = 7 bit address (8 bit address read = 0x7d)

To change the carrier number with the electronic DIP switch you have to send the following I2C command to the electronic DIP switch's EEPROM:


ACKNOWLEDGE
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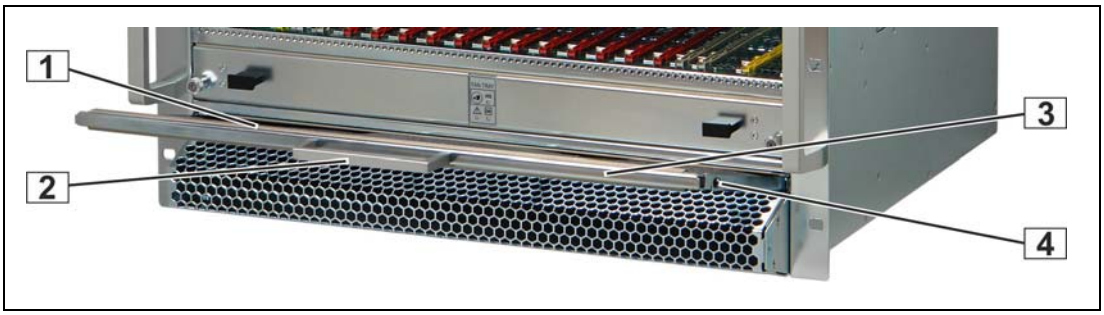
ACKNOWLEDGE
9
C (A0 = 0)
E (A0 = 1)
CARRIER NUMBER
S 1 0 0 1 1 1 A0 0 A 0 0 0 0 0 1 0 0 A 1 1 1 1 1 1 1 1 A X X X X d3 d2 d1 d0 A P
ADDRESS PCA9558
COMMAND BYTE
EEPROM ADDRESS
DATA FOR EEPROM

4 Air Filter

Figure 6: Air Filter



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1	Filter Element	3	Filter Tray
2	Handle	4	Spring mounted ball lock

4.1 Introduction

The MicroTCA Shelf provides a front replaceable air filter.

The filter meets the following standards and classifications:

- UL 900 Class 2, UL94 HF-1
- Telcordia NEBS GR-78-CORE
- Telcordia NEBS GR-63-CORE

4.2 Air Filter Replacement

The air filter can be removed by pulling the air filter's handle. To re-install, push the air filter into the guide rails at each side of the shelf until the spring mounted ball lock engage.

When installing the air filter, the filter element must be in top position

4.3 Air Filter Presence Sensor

The air filter presence is detected by aswitch located on the Backplane. The signal of the air filter presence sensor is hosted by the Cooling Units.

The presence sensor is defined as a digital sensor (present/not present) in the Cooling Unit‘s Sensor Data Record (SDR). When the air filter is pulled or re-inserted, the CU sends an SDR event message to the MCH.

5 Cooling Units

The MicroTCA Shelf provides two front-pluggable Cooling Units.
Each Cooling Unit contains three 12 VDC fans (290m³/h (171 cfm) each) for the AMC section, three 12 VDC fans (190 m³/h (111 cfm) each) for the µRTM section and a Schroff Cooling Unit Enhanced Module Management Controller (CU EMMC). The speed level of the AMC and the µRTM fans can be controlled independently. The CU EMMC has an Enhanced Module Management Controller (EMMC) onboard that communicate with the Carrier Manager over IPMB-0. The CU EMMC controls the fan speed, monitors the air filter sensor and provides hot-swap functionality.

During operation of the chassis, tha fans are controlled by the MCH.

For further informations about the cooling strategy and behaviour contact the MCH manufacturer.

Figure 7: Cooling Unit

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1	Fan 1	6	Fan 6
2	Fan 2	7	Hot Swap push button
3	Fan 3	8	CU 1
4	Fan 4	9	CU 2
5	Fan 5		

5.1 Emergency Cooling

If a fan fails or the connection to the MCH is lost, the EMMC increases the fan speed to the maximum. To check the connection to the MCH, the EMMC sends every 20 seconds the IPMI command GET_DEVICE_ID to the MCH and waits for an acknowledge. After 5 consecutive attempts, the EMMC sets the Cooling Unit to Local Mode and increases the fan speed to the maximum.

5.2 Cooling Unit IPMB Addresses

Table 2: Cooling Unit IPMB Addresses

Cooling Unit 1	0xA8
Cooling Unit 2	0xAA

5.3 Cooling Unit Connectors and Indicators

The display module at the cooling unit provides:

- A green LED – “In-Service”
- A red LED – “Out of Service”
- A blue LED – “Hot-Swap”
- A hot-swap push button

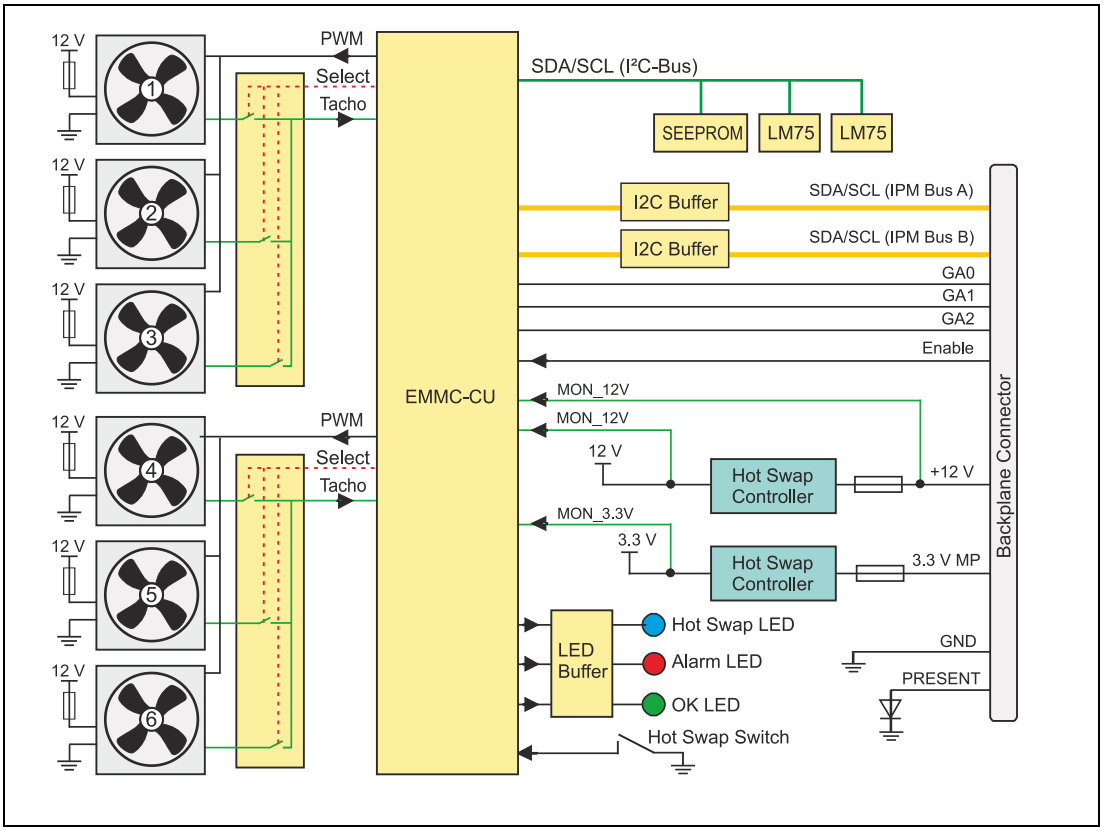
The hot-swap push button indicates to the MCH that the Cooling Unit is about to be removed. Once the operator pushes the hot-swap switch, the MCH is informed of the pending extraction. When the MCH feels it is “safe“ to remove the Fan Tray, the blue Hot-Swap LED illuminates solid.

Table 3: LEDs on Fan Tray front panel

Color	Description	Status	Condition
Green	In-Service LED	Off Solid green	No Power to the Fan Tray Normal Operation
Red	Alarm LED	Solid red	Attention Status (error condition)
Blue	Hot Swap LED	Off Short blink Solid blue	In use Preparing for extraction Ready to remove

5.4 Fan Controller Block Diagram

Figure 8: Fan Controller Block Diagram



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5.5 Cooling Capacity

The Schroff MTCA.4 Shelf provides airflow using two Cooling Units, one below and one above the card cage subrack. Each Cooling Unit has 6 fans moving air from the lower side to the upper side of the Shelf in a push-pull arrangement. This arrangement provides excellent airflow as well as fault tolerance in the unlikely event of a fan failure. The maximum power available to an AMC/µRTM combination is 80 W, the average power on the µRTM shall not exceed 30 W. The shelf cooling capacity for the AMC front boards is 80 W/board, the cooling capacity for the µRTM boards is 30 W/board ($\Delta t \approx 10$ K).

Figure 9: Airflow Test Board Pressure Drop

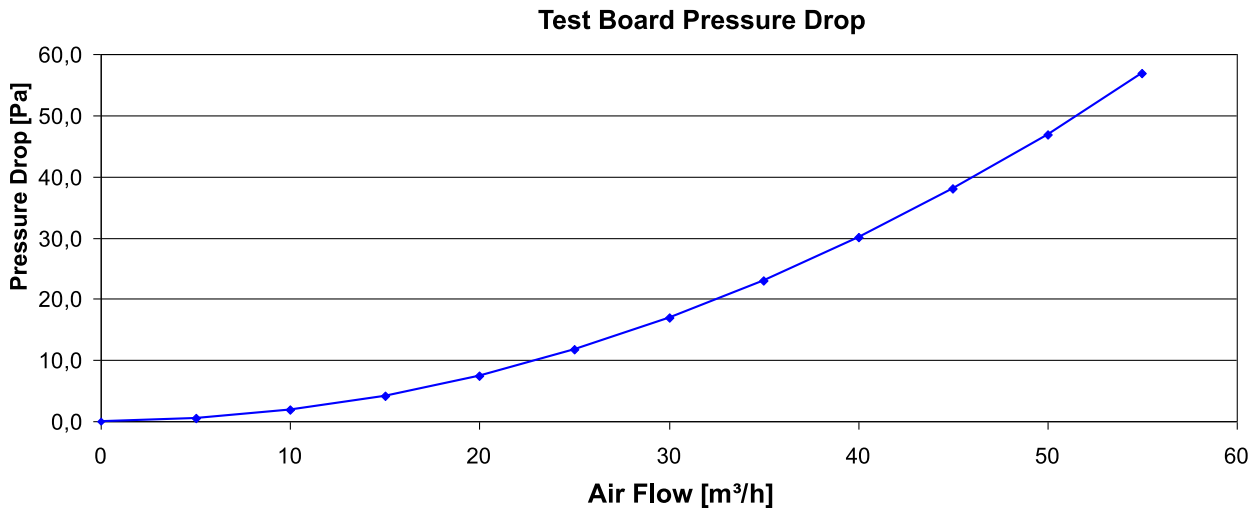


Figure 10: Front Airflow

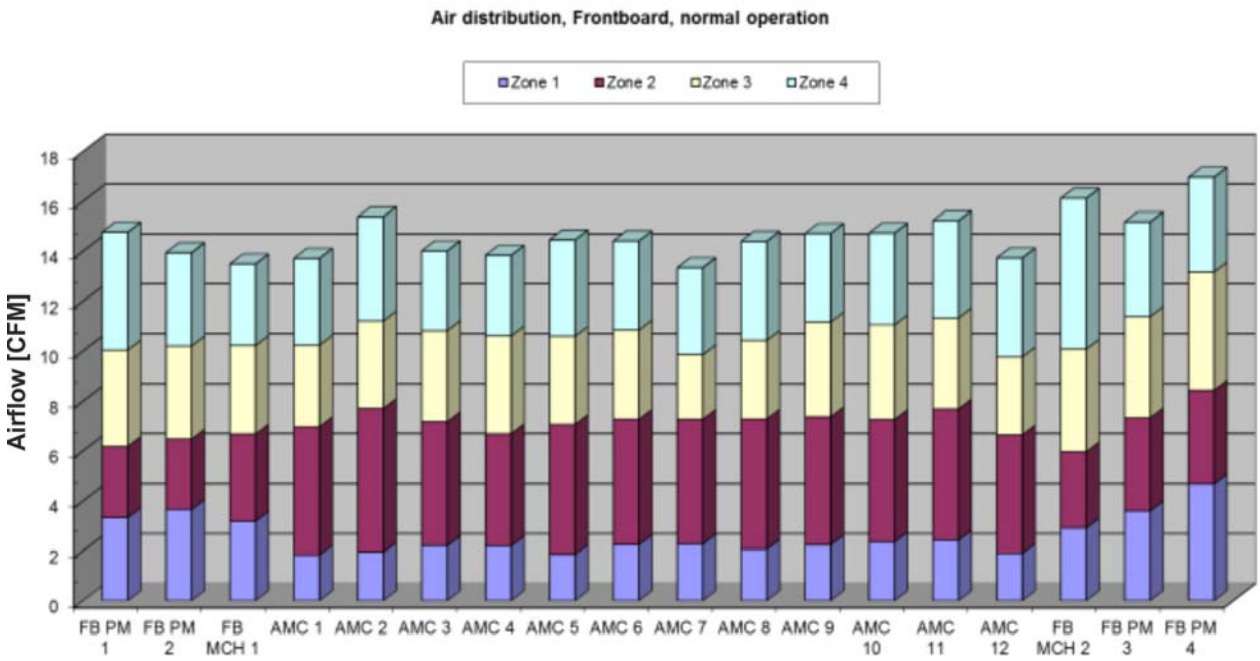
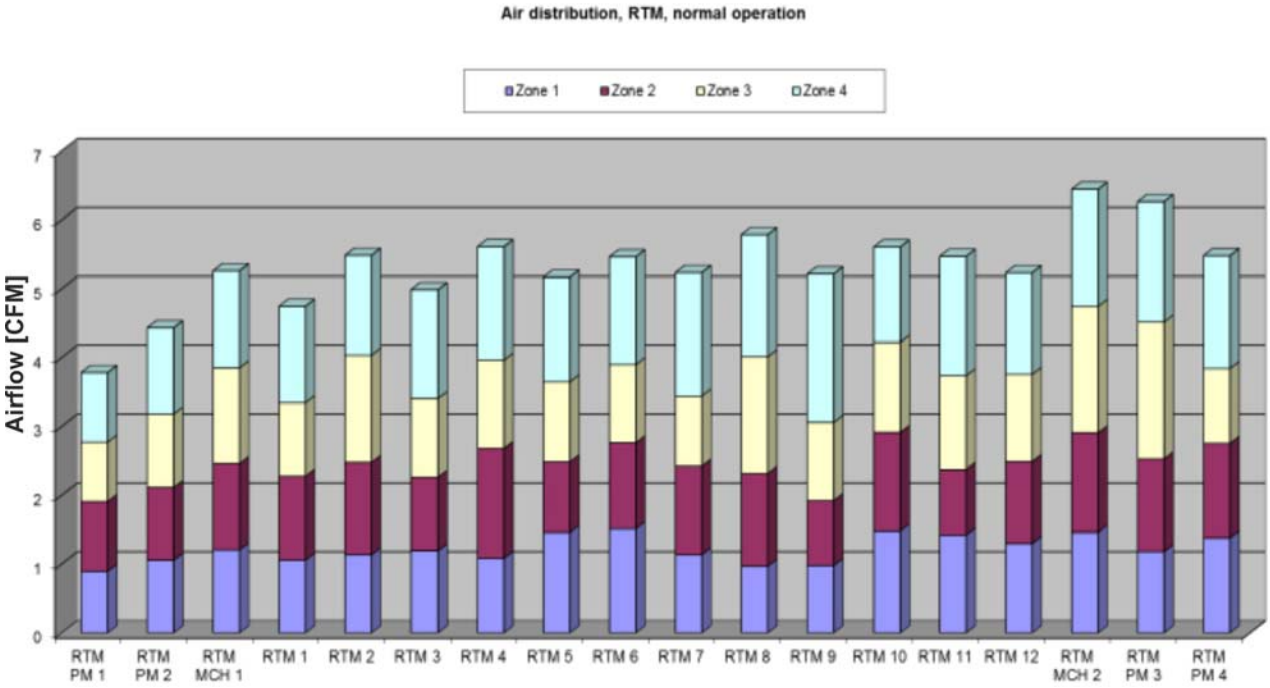


Figure 11: Rear Airflow

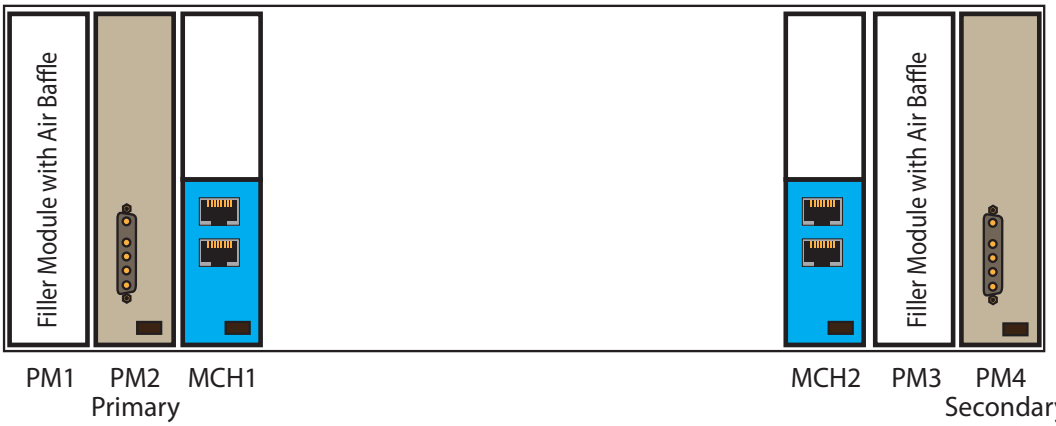


6 Power

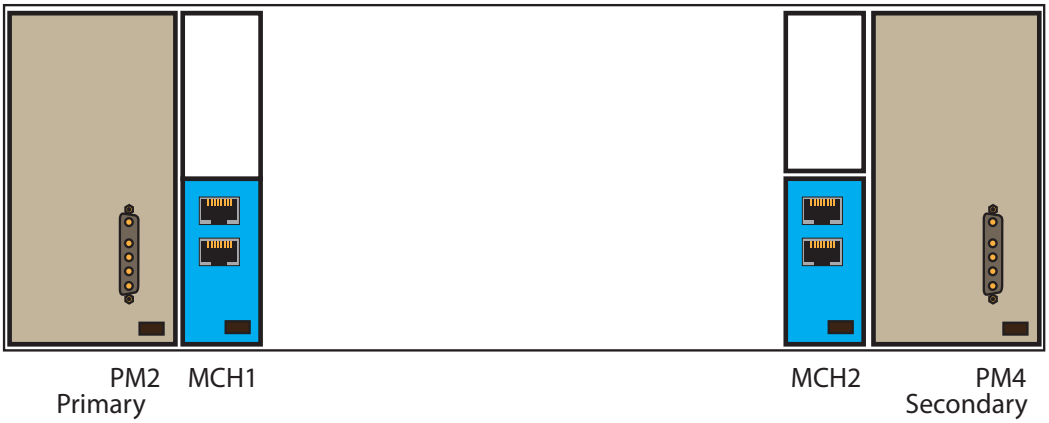
The MTCA.4 system provides 4 Power Module (PM) slots for Double Full-size Power Modules or for 2 x 12 HP Power Modules.
In the factory default FRU file PM2 is defined as primary Power Module, PM4 is the secondary (backup)Power Module.

To power-up the system, at least one Power Module must be plugged into slot PM2.

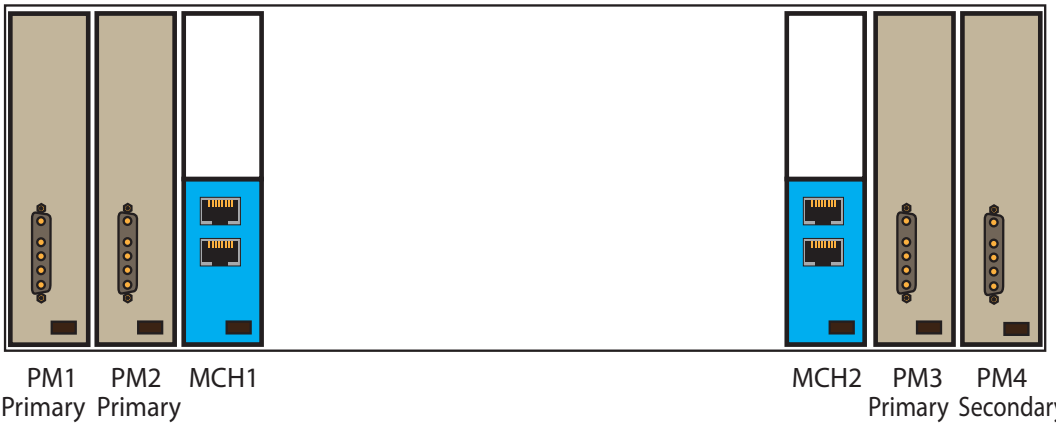
Example 1: 2 x Double Full-size Power Modules (Supported by factory FRU File)



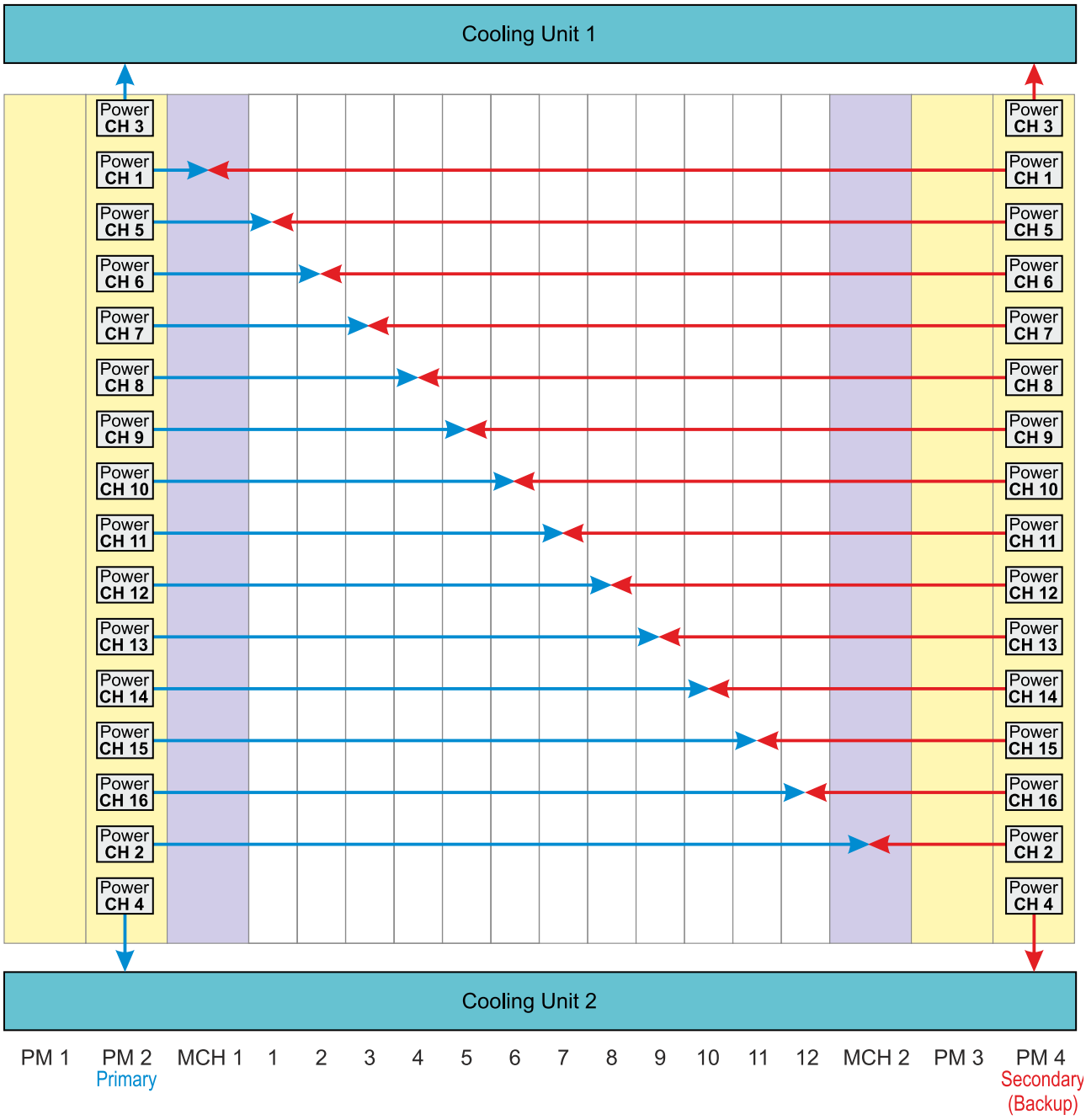
Example 2: 2 x Double 12 HP Power Modules (Supported by factory FRU File)



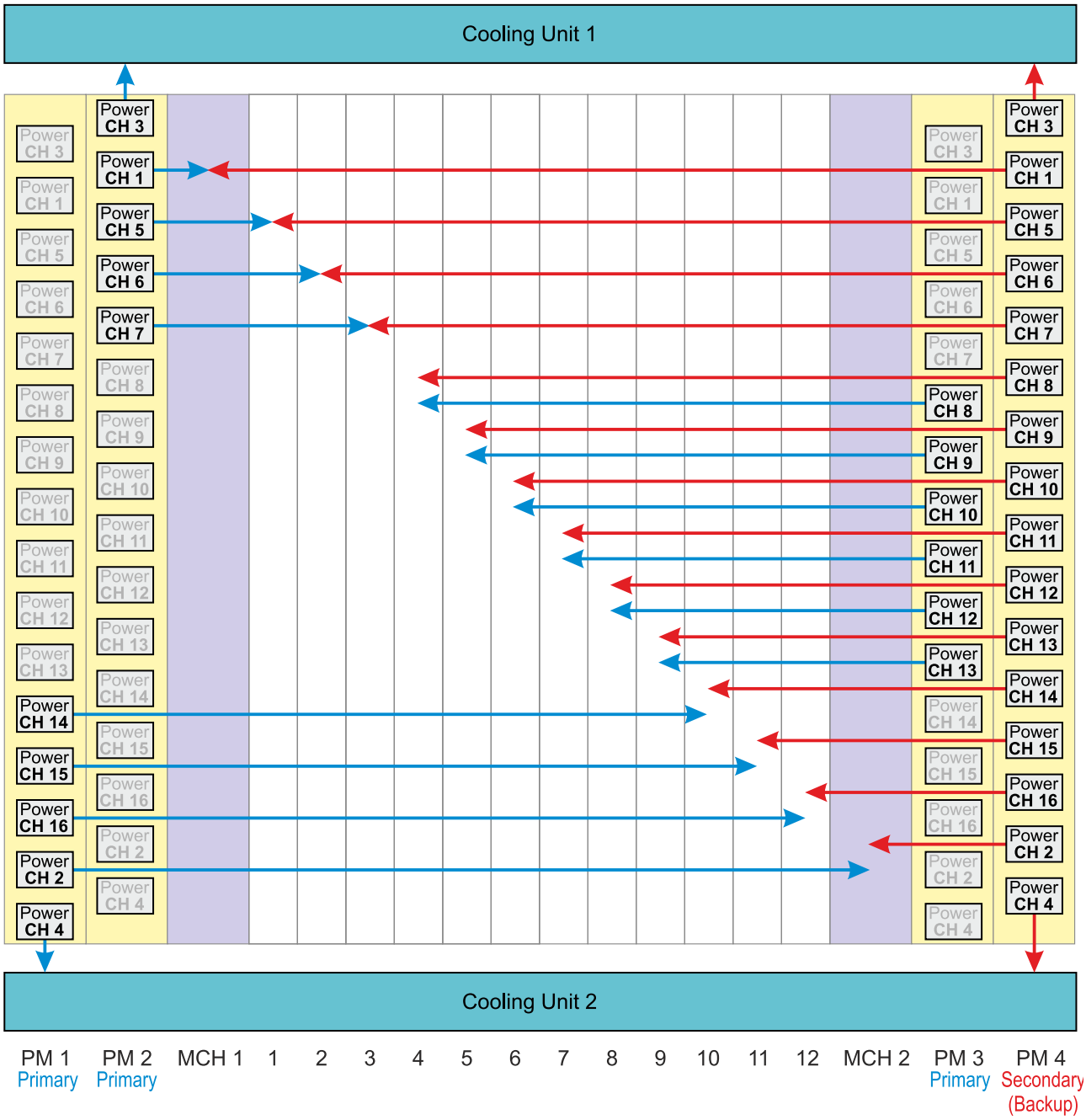
Example 1: 4 x Double Full-size Power Modules (Custom specific FRU File)



Factory default power setup



Example of the Power Channel allocation in a custom-specific setup with 3 primary Power Modules and 1 secondary Power Module



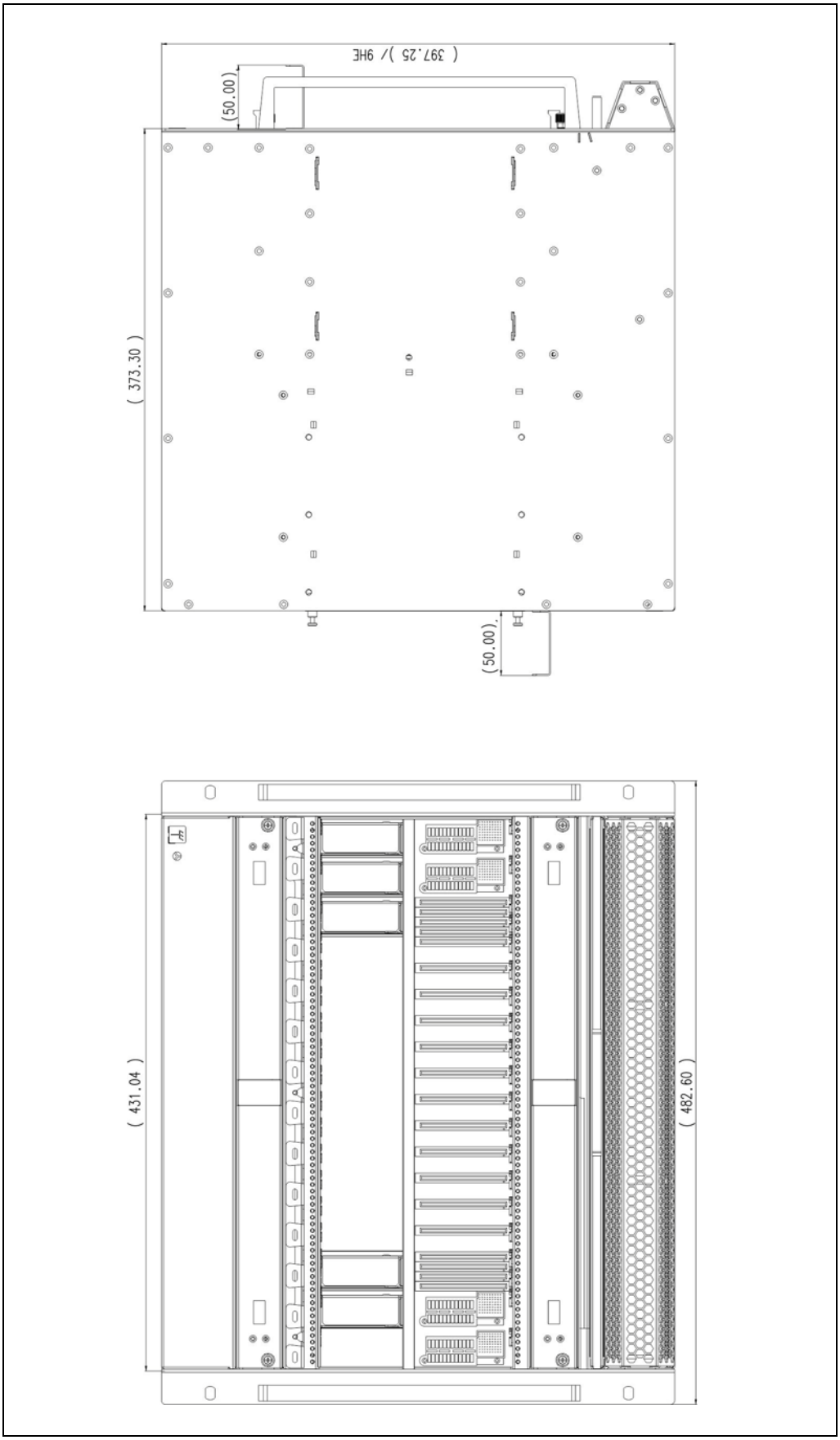
7 Technical Data

Table 4: Technical Data

Physical Dimensions	
Height	397,25 mm (9 U)
Width (with mounting brackets)	482,60 mm
Depth	373,3 mm
Depth (with front and rear cable trays)	473,3 mm
Weight	
Weight completely assembled	20 Kg
Environmental	
Ambient temperature	+5°C...+50°C
Humidity	+5%...+85%, non-condensing

7.1 Shelf Dimensions

Figure 12: Shelf Dimensions



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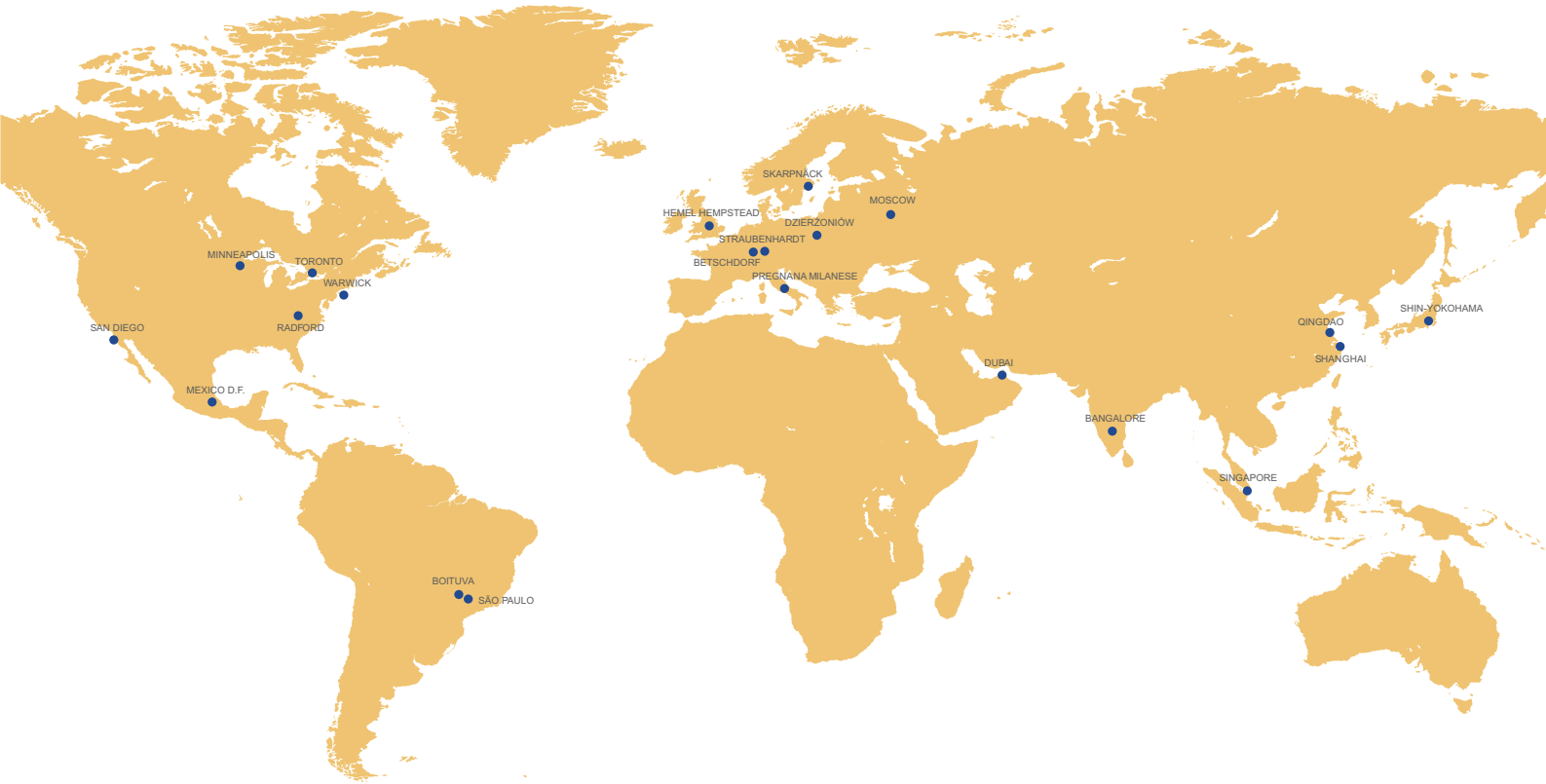

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